

**AMENDMENTS TO THE CLAIMS:**

*This listing of claims will replace all prior versions, and listings, of claims in the application:*

1. (Currently amended) A data processing device which reads out program instructions ~~from~~ an instruction region ~~from in a main memory means~~ and writes a result of a computation into the main memory ~~means~~,

the data processing device comprising:

first computing means for performing a computation based on one or more instructions in the instruction region which are read out from the main memory ~~means~~;

a register by which the first computing means ~~reads out or writes~~ and reads data to/from the main memory ~~means~~;

input/output group generating means for generating an input/output ~~group~~ group, which is made up of an input pattern comprising one or more input elements and an associated output pattern ~~pattern~~ comprising one or more output elements, at ~~the~~ a time of execution of one or more program instructions in the instruction region by the first computing means; and

~~instruction region~~ input/output group storage means for storing the input/output group ~~generated by in an instruction region storage section of~~ the input/output group generating means, wherein

at the time of execution of instructions read out from the instruction region in main memory, if ~~the~~ an input pattern ~~of in~~ the instruction region is matched with an input pattern stored in the ~~instruction region storage means in the~~ input/output group, the first computing means ~~performing reuse so that the output pattern, which is stored in the instruction region storage means in association with the input pattern, is outputted to~~ performs a reuse operation

that outputs the associated output pattern to the register and/or the main memory-means, and  
wherein

the input/output group generating means-including: also generates a-dependency relations  
storage section-which information, which is stored in a dependency relations storage section, that  
indicates from which input element in the input pattern of the input/output group that each output  
element in the-an associated output pattern derives is derived; and

input/output group setting means for setting, based on ~~information stored in the~~  
~~dependency relations storage section~~ information, an input/output group ~~which-that~~ is made up of  
an output pattern including at least one said output element and an input pattern including at least  
one said input element.

2. (Currently amended) The data processing device as defined in claim 1, wherein;  
~~in a case where~~ if a first group of input elements, from which a first output element  
~~derives-is derived,~~ is all-included in-entirely within a second group of input elements, from which  
a second output element different from the first output element ~~derives-is derived,~~ the  
input/output group setting means sets: (i) the second group as the input pattern and (ii) the first  
group and the second group as the output pattern.

3. (Currently amended) The data processing device as defined in claim 1, wherein;  
~~in a case where~~ if there is no shared input element between a first group of input  
elements, from which a first output element ~~derives-is derived,~~ and a second group of input  
elements, from which a second output element different from the first output element ~~derives-is~~  
derived, the input/output pattern group setting means sets: (i) a first input/output group in which

the first group of the input elements is the input pattern and the first output element is the output pattern and (ii) a second input/output group in which the second group of the input elements is the input pattern and the second output element is the output pattern.

4. (Currently amended) The data processing device as defined in claim 1, ~~wherein,~~  
wherein

the dependency relations storage section is made up of a ~~2D-arranged two-dimensional~~  
(2D) matrix-arranged memory portion in which row elements of the matrix-arranged memory are  
stored with the output elements are row elements and column elements of the matrix-arranged  
memory are stored with the input elements are column elements, and each of memory elements  
element of the 2D-arranged 2D matrix-arranged memory has includes information regarding  
indicating whether or not an output element corresponding to a row element ~~of the memory~~  
~~element is derived from an input element corresponding to a column element of the memory~~  
~~element.~~

5. (Currently amended) The data processing device as defined in claim 4, wherein,  
~~in a case where a~~ readout from the register and/or the main memory ~~means is carried out~~  
is performed when the first computing means performs ~~the calculation of a computation based on~~  
one or more instructions obtained from the instruction region, then the input/output group  
generating means further performs operations of:

(1) when an address of the register and/or the main memory ~~means from which~~  
~~the readout is carried out performed~~ has been registered, ~~as an output element,~~ in the  
dependency relations storage section as an output element, a process to temporarily store-storing

a provisional matrix ~~which is made up of comprising~~ a row ~~element, element~~ of the dependency relations storage section, ~~which wherein said row~~ element corresponds to the output element;

(2) when an address of the register and/or the main memory ~~means~~ from which the readout is ~~carried out performed~~ is registered, ~~as an input element rather than an output element,~~ in the dependency relations storage section, ~~a process to~~ as an input element rather than an output element, temporarily ~~store~~ storing a provisional matrix in which a memory element corresponding to a ~~column, column~~ element of the dependency relations storage section, ~~which wherein said column element~~ corresponds to the input element and wherein said column element is set at 1 to a logical "1", and remaining memory elements are ~~set at 0~~ to a logical "0"; and

(3) when an address of the register or the main memory ~~means~~ from which the readout is ~~carried out performed~~ is registered, ~~registered~~ in the dependency relations storage section, ~~section~~ as neither an output element nor an input element, ~~a process to~~ (i) ~~register~~ registering, as input elements, the address and its value in the dependency relations storage section, and (ii) temporarily ~~store~~ storing a provisional matrix in which a memory element ~~corresponding corresponds~~ to a ~~column, column~~ of the dependency relations storage section, ~~which wherein said column~~ corresponds to the input element ~~is set at 1 and said column is set to a logical "1",~~ and remaining memory elements are ~~set at 0,~~ to a logical "0"; and

in a ~~ease~~ condition where writing is ~~carried out performed~~ to the register and/or the main memory means, the input/output group generating means ~~performs~~ further performing:

(4) when an address of the register and/or the main memory ~~means~~ to which the writing is ~~carried out performed~~ is registered as an output element, ~~a process to~~ (iii) update updating an output value corresponding to the registered output element to the written value, (iv)

~~replace~~ replacing a row ~~element~~, element of the dependency relations storage section, ~~which~~ wherein said row element corresponds to the registered output element, with a logical OR of all provisional matrices temporarily stored at ~~the~~ that time, and (v) then ~~initialize~~ initializing the temporarily-stored provisional matrices; and

(5) when an address of the register and/or the main memory means to which the writing ~~is carried out~~ performed is not registered as an output element, ~~a process to~~ (vi) register registering the address and its ~~value~~, value as output ~~elements~~, element in the dependency relations storage section, (vii) ~~replace~~ replacing a row ~~element~~, element of the dependency relations storage section, ~~which~~ wherein said row element corresponds to the output element, with a logical OR of all provisional matrices temporarily stored at ~~the~~ that time, and (viii) then ~~initialize~~ initializing the temporarily-stored provisional matrices.

6. (Currently amended) The data processing device as defined in claim 4, wherein, the input/output group setting means includes a rows AND comparison section which performs a logic ~~operation~~ AND operation of the row elements in the ~~2D-arranged~~ 2D matrix- arranged memory, and

in the dependency relations storage section, the input/output group setting means (i) extracts a group of row elements ~~in~~ for which a logical AND operation of an inversion of a first row element and a second row element ~~is all 0~~ are each a logical "0", and (ii) among the extracted group of the row elements, excludes, from a candidate as the input/output group, row elements other than a row element ~~which~~ that includes ~~the~~ a largest number of the input elements.

7. (Currently amended) The data processing device as defined in claim 4, wherein,  
the input/output group setting means includes a rows AND comparison section which performs a logic operation AND of the row elements in the ~~2D-arranged~~ 2D matrix-arranged memory, and

in the dependency relations storage section, the input/output group setting means sets, as the input/output group, a row element whose logical AND operation with any other row elements ~~is all 0~~ are all a logical "0".

8. (Currently amended) The data processing device as defined in claim 1, further comprising at least one second computing means,

wherein in regard of the instruction region processed by the first computing means, the second computing means ~~subjecting~~ subjects the instruction region to a computation based on a predicted input value ~~which is assumed to be inputted hereafter~~, and ~~registering~~ registered a result of the computation in the instruction region storage ~~means~~ section.

9. (Currently amended) The data processing device as defined in claim 1, wherein,  
the input/output group setting means ~~includes~~ further comprises:  
an ~~output-side~~ output-side group storage section which stores information of an input/output group to which each of the output elements belongs;

an ~~input-side~~ input-side group storage section which stores information of an input/output group to which each of the input elements belongs;

a temporal storage section which stores a changed dependency relation between an output element and an input element, ~~when~~ whenever there is a change in the information stored in the dependency relations storage section while the input/output group is generated; and

a group temporal storage section which stores information of a changed input/output group when there is a change in information stored in the dependency relations storage section while the input/output group is generated.

10. (Currently amended) The data processing device as defined in claim 9, ~~wherein,~~  
wherein

the input/output group setting means further includes a group management section that stores information of the input/output group which has ~~already previously~~ been allocated to the output element and/or the input ~~element,~~ element while the input/output group is being generated.

11. (Currently amended) The data processing device as defined in claim 9, ~~wherein,~~  
wherein

the dependency relations storage section is made up of a ~~2D-arranged~~ two-dimensional (2D) matrix-arranged memory portion in which row elements of the matrix-arranged memory are stored with the output elements ~~are row elements and~~ column elements of the matrix-arranged memory are stored with the input elements ~~are column elements,~~ and each of memory elements element of the ~~2D-arranged~~ 2D matrix-arranged memory ~~has~~ includes information ~~regarding~~ indicating whether or not an output element corresponding to a row element ~~of the memory~~

~~element~~ is derived from an input element corresponding to a column element ~~of the memory~~  
element.

12. (Currently amended) The data processing device as defined in claim 11, ~~wherein,~~  
wherein

the temporal storage section stores a logical OR of memory elements of a plurality of  
rows in the dependency relations storage section, and

the group temporal storage section stores (i) a logical OR of memory elements of a  
plurality of rows in the output side group storage section and/or (ii) a logical OR of memory  
elements corresponding to a plurality of input elements in the input side group storage section.

13. (Currently amended) The data processing device as defined in claim 9, ~~wherein,~~  
wherein

the input/output group setting means further includes a conditional branch storage section  
~~which that~~ stores, ~~when a conditional branch instruction is detected while the input/output group~~  
~~is generated,~~ information regarding an input element on which the conditional branch instruction  
depends whenever a conditional branch instruction is detected while the input/output group is  
generated.

14. (Currently amended) The data processing device as defined in claim 12, wherein,  
~~in a case~~ under a condition where readout from the register and/or the main memory  
means is carried out while the first computing means performs a calculation of the input region,  
the input/output group generating means further performs operations of:



(1) when an address of the register and/or the main memory means from which the readout is ~~carried out performed~~ has been registered, registered as an output ~~element~~, element in the dependency relations storage section, a ~~process to temporarily store~~ storing, in the temporal storage section, a logical OR of (i) a row ~~element~~, element of the dependency relations storage section, ~~which wherein said row element corresponds to the output element~~ element, and (ii) ~~the elements~~ in the temporal storage section, and ~~store~~ storing, in the group temporal storage section, a logical OR of (iii) a row ~~element~~, element of the output side group storage section, ~~which wherein said row element corresponds to the output element~~ and (iv) ~~the elements~~ in the group temporal storage section;

(2) when an address of the register and/or the main memory ~~means~~ from which the readout is ~~carried out performed~~ is registered, registered as an input element rather than an output ~~element~~, element in the dependency relations storage section, a ~~process to store~~, storing in the temporal storage ~~section~~, section information in which a memory element corresponding to a ~~column~~, column of the dependency relations storage section, ~~which wherein said column corresponds to the input element~~ and is set at 1 to a logical "1" and remaining memory elements are set at 0, and ~~store~~, storing in the group temporal storage ~~section~~, section a logical OR of (v) elements, ~~in the input side from the input-side group storage section~~, which section that correspond to the input element and (vi) the elements in the group temporal storage section; and

(3) when an address of the register and/or the main memory ~~means~~ from which the readout is ~~carried out performed~~ is not registered in the dependency relations storage section as either an output element or an input element, a ~~process to register~~, registering as input elements, the address and its value in the dependency relations storage section, and temporarily ~~store~~ storing a provisional matrix in which a memory element corresponding to a column, of the

dependency relations storage section, which corresponds to the input element is set at 1 while remaining memory elements are set ~~at 0~~ to a logical "0", and

~~in a case~~ under a condition where writing is carried out to the register and/or the main memory ~~means~~, the input/output group generating means further performs operations of:

(4) when an address of the register and/or the main memory ~~means~~ to which the writing is ~~carried out~~ performed is registered as an output element, ~~a process to update~~ updating an output value corresponding to the registered output element to the written value, ~~replace~~ replacing a row element, element of the dependency relations storage ~~section, which section~~ wherein said row element corresponds to the registered output element, with the information temporarily stored in the temporal storage section at the time, and ~~update~~ (viii) updating the information in the output side group storage section, which information corresponds to the output element, and (ix) updating the information in the input side group storage section, which information corresponds to the input elements on which the output element depends, based on the information stored in the group temporal storage section; and

(5) when an address of the register and/or the main memory ~~means~~ to which the writing is carried out is not registered as an output element, ~~a process to register~~ registering the address and its ~~value~~, value as output ~~elements~~, element in the dependency relations storage section, ~~replace and replacing a row element, element~~ of the dependency relations storage section, ~~which wherein said row element~~ corresponds to the output element, with the information temporarily stored in the temporal storage section at ~~the~~ that time, and ~~update~~ (x) updating the ~~information, information~~ in the ~~output side~~ output-side group storage section, ~~which wherein~~ said information corresponds to the output element, and (xi) updating the information, information in the input side group storage section, ~~which wherein said~~ information corresponds

to the input elements on which the output element depends, based on the information stored in the group temporal storage section.

15. (Currently amended) The data processing device as defined in claim 1, wherein, the instruction region storage ~~means~~ section includes input pattern storage ~~means~~ section which stores ~~the~~ input patterns as a tree structure in which items that are to be subjected to equal comparison are regarded as nodes.

16. (Currently amended) The data processing device as defined in claim 15, ~~wherein,~~ ~~the~~ further comprising input pattern storage means ~~realizes that organizes~~ the tree structure in such a manner that a value of an item in the input pattern, which item is subjected to equal comparison, is stored in association with an item which is to be next subjected to a comparison ~~next~~.

17. (Currently amended) The data processing device as defined in claim 16, wherein, the input pattern storage means further includes an associative search means and an additional information storage ~~means~~ section, wherein the associative search means includes one or more search target ~~line which includes:~~ lines that include a value storage area ~~where-in which~~ a value of an item to be subjected to equal comparison is ~~stored;~~ stored, and a key storage area where a key for identifying each item is ~~stored;~~ stored; and

the additional information storage ~~means~~ has section a search item designation area in which an item to be next subjected to an associative search ~~next~~ is stored in accordance with a ~~corresponding~~ line corresponding to said one or more search target line.

18. (Withdrawn- Original) A data processing device which reads out an instruction region from main memory means and writes a result of a computation into the main memory means,

the data processing device comprising:

first computing means for performing a computation based on the instruction region read out from the main memory means;

a register by which the first computing means reads out or writes data to/from the main memory means; and

input/output pattern storage means for storing an input pattern and an output pattern which are a result of execution of a plurality of instruction regions,

in a case where the first computing means executes an instruction region and an input pattern of the instruction region is matched with an input pattern stored in the input/output storage means, a reuse process is performed so that an output pattern, which is stored in the input/output storage means in association with the input pattern, is outputted to the register and/or the main memory means,

the data processing device further comprising:

registration processing means for (i) distinguishing, among the input elements in the input pattern, an input element to be subjected to prediction from an input element not requiring prediction, at the time of storing, in the input/output storage means, a result of execution of the instruction region by the first computing means, and (ii) registering, in the input/output storage means, information regarding the distinction;

prediction processing means for predicting a variation of a value of the input element to be subjected to prediction among the input elements stored in the input/output storage means, based on the information regarding the distinction; and

second computing means for subjecting the instruction region to precomputation, based on the input element predicted by the prediction processing means,

a result of the precomputation of the instruction region by the second computing means being stored in the input/output storage means.

19. (Withdrawn- Original) The data processing device as defined in claim 18, wherein, in a case where (i) an address of the register used for input is used as a stack pointer or a frame pointer or (ii) a writing instruction to the address is a constant setting instruction, the registration processing means sets a constant flag in the address, as the information for the distinction, while in a case where neither (i) or (ii) holds true, the registration processing means resets a constant flag of the address.

20. (Previously presented) The data processing device as defined in claim 18, wherein, in a case where an input element is newly stored in the input/output storage means, the registration processing means resets, as the information for the distinction, a change flag in an address of the input element, while, in a case where, after the input element is stored in the input/output storage means, a storing instruction is executed with respect to the address, the registration processing means sets a change flag in the address.

21. (Withdrawn- Original) The data processing device as defined in claim 19, wherein,

in a case where an input element is newly stored in the input/output storage means, the registration processing means resets, as the information for the distinction, a history flag in an address of the input element, while, in a case where, at the time of execution of a load instruction with respect to the address, the constant flag is set in a register address from which the address is generated, the registration processing means sets a history flag in the address.

22. (Withdrawn- Original) The data processing device as defined in claim 21, wherein,  
in a case where an input element is newly stored in the input/output storage means, the registration processing means resets, as the information for the distinction, a flag of an address of the input element, while, after the input element is stored in the input/output storage means, a storing instruction is executed with respect to the address, the registration processing means sets a change flag in the address, and

the prediction processing means performs prediction of a variation of an input element, as to an address in which the change flag and the history flag are set, among addresses of the input elements stored in the input/output storage means.

23. (Withdrawn-Previously presented) The data processing device as defined in claim 18, wherein,

the prediction processing means performs prediction of a variation of an input element, only as to an input element in which a variation of a value of the input element in the history is not 0, among the input elements stored in the input/output storage means.

24. (Withdrawn- Original) The data processing device as defined in claim 18, wherein,

when the result of execution of the instruction region by the first computing means is stored in the input/output storage means, the registration processing means (i) distinguishes, among the input elements in the input pattern, an input element to be subjected to prediction from an input element not requiring prediction, (ii) registers information regarding the distinction in the input/output storage means, (iii) counts how many times storing is carried out at the time of execution of the instruction region, as to the output elements of the output pattern stored in the input/output storage means, and (iv) store the counted value in the input/output storage means, and

the second computing means (i) subjects the instruction region to precomputation, based on the input element having been predicted by the prediction processing means, and (ii) performs the precomputation of the instruction region by waiting for a time corresponding to the number of times of storing performed with respect to the input element based on the counted value, and then performing readout from the main memory.

25. (Withdrawn- Original) The data processing device as defined in claim 24, wherein, the input/output storage means includes an input/output storage area which temporarily stores an input pattern and an output pattern which are the result of execution of the instruction region by the first computing means, and

the input/output storage area includes a store counter which counts how many times the storing is carried out with respect to each of the output elements.

26. (Withdrawn- Original) The data processing device as defined in claim 25, wherein,

the input/output storage means includes a history storage area which stores a history of a past result of execution of each instruction region subjected to computation by the first computing means, and

the registration processing means (i) stores, in the history storage area, the result of execution which is stored in the input/output storage area, and (ii) with respect to an input element having an address identical with an address of an output element which is stored, in the history storage area, as a result of execution of the last time, registers a store counter of a corresponding directly-preceding output element, as a store counter of the input element.

27. (Withdrawn- Original) The data processing device as defined in claim 26, wherein, the input/output storage means includes a predicted value storage area which stores an input element predicted by the prediction processing means, and

the prediction processing means subjects, to prediction, an input element whose value consistently varies between execution histories, among the input elements stored in the history storage area, and stores a result of the prediction in the predicted value storage area.

28. (Withdrawn- Original) The data processing device as defined in claim 26, wherein, the input/output storage means includes a waiting-required address storage area which stores an input element that should be read out from the main memory after waiting for a time corresponding to the number of times of the storing, and

with respect to an input element whose address in an execution histories does not change and whose variation of a value between the execution histories is inconsistent, the prediction



processing means stores, in the waiting-required address storage area, the store counter and a waiting counter as a value based on a predicted distance.

29. (Withdrawn- Original) The data processing device as defined in claim 26, wherein, the input/output storage means includes a waiting-required address storage area which stores an input element that should be read out from the main memory after waiting for a time corresponding to the number of times of the storing, and

with respect to an input element whose address changes between execution histories and values of changed addresses change on account of the storing, among the input elements stored in the history storage area, the prediction processing means stores, in the waiting-required address storage area, a waiting counter as a value based on the store counter.

Claims 30 and 31 (Canceled).